

## APPENDIX C

### OWL NETWORK FRAME FORMATS

### General format of an LLC frame.

Pre- amble	Flag	MAC-D Header	MAC-R Header	MAC-R Parms	Length/ Type	LLC Header	LLC Data	CRC	Flag
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### General Field Definitions for an LLC frame on a radio link.

Physical Layer Header	L bytes
MAC-D Protocol ID	1 byte (hexadecimal 01)
MAC-D Control	1 byte
MAC-D Destination Node ID	2 bytes
MAC-D Source Node ID	2 bytes
MAC-D OWL LAN ID	1 byte
MAC-D Channel Reservation	1 byte
MAC-R Control	2 bytes
MAC-R 802 Destination Address	6 bytes
MAC-R 802 Source Address	6 bytes
MAC-R Sequence	2 bytes
MAC-R Optional Parms	M bytes
802.3 Length or DIX Version 2 Type	2 bytes
LLC DSAP	1 byte
LLC SSAP	1 byte
LLC Control	1 bytes
optional SNAP header	5 bytes
LLC Data	N bytes
Physical Layer Trailer	P bytes

All multi-byte fields are transmitted in "big-endian" byte order (high byte first). Bit 0 is the low-order bit.

### 16-bit Network Node Identifier.

bit 15	Multicast Flag
0	unicast frame
1	multicast or broadcast frame

bit 14-13	Node Type
10	Terminal
01	Access Point (AP)
11	All Nodes

bit 12-0	Node Identifier
all 0's	root node identifier
all 1's	node without a network node identifier or any node

bit 2-0	Port Identifier for Access Point
all 1's	any port

Hexadecimal 2000 is the well-known 16-bit node ID of the root node.  
 Hexadecimal DFFF is the multicast default node ID of a terminal node.  
 Hexadecimal BFFF is the multicast default node ID of an access point.  
 Hexadecimal FFFF is the broadcast node ID for all nodes.

### MAC-D Header.

#### Ethernet MAC-D Header.

802 Hop Destination Address	6 bytes
802 Hop Source Address	6 bytes
DIX Version 2 Type	2 bytes
MAC-D OWL Protocol ID	1 byte (hexadecimal 40)
MAC-D Control	1 byte
MAC-D LAN ID	1 byte
MAC-D Fragment ID	1 byte
MAC-D Length	2 bytes

#### Radio MAC-D Header.

MAC-D Protocol ID	1 byte (hexadecimal 40)
MAC-D Control	1 byte
MAC-D Destination Node ID	2 bytes
MAC-D Source Node ID	2 bytes
MAC-D LAN ID	1 byte
MAC-D Channel Reservation	1 byte

## MAC-D Control Byte (8 bits).

Bits 7-4 in the MAC-D control byte are used to specify the frame type. A MAC-D PDU is classified as either a request or poll frame, depending on the state of the R/P bit. Poll frames are always control frames. A request MAC-D PDU can be either a control or data frame, depending on the state of the CONTROL bit. The MODE bit is set to 1, to indicate master/slave mode, for any frames sent during a contention free period; otherwise, the MODE bit is 0 to indicate random access mode.

### Data frames.

#### *Data request control byte.*

bit 7	R/P	0 = request frame
bit 6	CONTROL	0 = data frame
bit 5	START	1 = first-in-chain
bit 4	STOP	1 = last-in-chain
bit 3	SEQ	sequence number, modulo 2
bit 2	PRIORITY	0=normal data, 1=high priority
bit 1	(reserved)	must be zero
bit 0	MODE	0=random access, 1=master/slave

The START bit is set ON in the first frame fragment in a series of fragments associated with a single MAC-D PDU.

The STOP bit is set ON in the last frame fragment in a series of fragments associated with a single MAC-D PDU.

### Control frames.

#### *Request control byte.*

bit 7	R/P	0 = request frame
bit 6	CONTROL	1 = control frame
bit 5-4	TYPE	10 = RFP 00 = ENQ 01 = ABORT 11 = NSP
bit 3-1	(reserved)	must be zero
bit 0	MODE	0=random access, 1=master/slave

*Poll control byte.*

bit 7	R/P	1 = poll frame
bit 6	(reserved)	must be zero
bit 5-4	TYPE	00 = NSP-ACK 01 = REJECT 10 = CLEAR 11 = POLL
bit 3	SEQ	sequence number, modulo 2
bit 2-1	(reserved)	must be zero
bit 0	MODE	0=random access, 1=master/slave

**Non-specific Poll (NSP) frame format.**

MAC-D Header	8 bytes
NSP Flags	4 bits (currently must be zero)
NSP Level	4 bits
NSP Rotation	4 bits
NSP Level 0 Expansion Flags	4 bits
NSP Level 1 Expansion Flags	16 bits
NSP Level 2 Expansion Flags	64 bits

**NSP-ACK frame format.**

MAC-D Header	8 bytes
Priority (total wait time in .1 sec. units)	1 byte
Reservation Request	1 byte

**MAC-R Header.**

MAC-R Control	2 bytes
MAC-R 802 Destination Address	6 bytes
MAC-R 802 Source Address	6 bytes

If the RELAY bit is 1 in the MAC-R control field, then the MAC-R header includes the 802 hop source address. The hop source address is the 802 address of the relay node which forwarded the inbound packet. The RELAY bit is never ON in outbound packets.

MAC-R Control	2 bytes
MAC-R 802 Hop Source Address	6 bytes
MAC-R 802 Destination Address	6 bytes
MAC-R 802 Source Address	6 bytes

**MAC-R Control Bytes (16 bits).**

bit 15	Network type	0 = hierarchical, 1 = point-to-point
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bit 14	(reserved)	must be zero
bit 13	Outbound Flag	1 = outbound
bit 12	REQ/RSP	0 = request, 1 = response
bit 11	(reserved)	must be zero
bit 10-8	MAC-R PDU Type	(see table below)
bit 7	MAC-R Parms Flag	1 = optional MAC-R parms
bit 6-4	(reserved)	must be zero
bit 3	MAC-R Retry Flag	1 = retry
bit 2	ATTI	1 = attach indication
bit 1	Relay Flag	0=from a child or parent, 1=relayed inbound PDU
bit 0	(reserved)	must be zero

### MAC-R PDU Types.

000	Data/R-Data PDU
001	Alert PDU
010	Hello PDU
011	Attach PDU
100	Detach PDU
101	ECHO PDU
110	Registration PDU
111	(reserved)

### Optional Bridge Parameters - general format.

1-bit end-of-parms flag	1 = last optional parm
7-bit parm type	(see table below)
1-byte parm length	length of parm value field in bytes
M-byte parm value	(value or list of values)

## Optional Parameters.

Parm Type	Parm Length	Description
02h	6 bytes	802 address.
03h	N*4	Detach List. A list of 4-byte detach records. Each record consists of a 2-byte node ID followed by a 2-byte alert ID. The detach ID corresponds to an attach ID.
04h	N*4	Alert List. A list of 4-byte alert records. Each record consists of a 2-byte node ID followed by a 2-byte alert ID. The alert ID corresponds to an attach ID.
05h	N*2	Pending Message List. A list of 2-byte Node IDs.
07h	N bytes	Well-known alias.
08h	N*6 bytes	Remote Attach List. A list of 802 addresses for stations on a secondary LAN.
09h	1 byte	Load Indicator. An indication of the channel load based on frame frequency.
0Ch*	1 or 2 bytes	Awake time (in 100 millisecond units). All 1's denotes forever.
0Dh*	1 or 2 bytes	Awake time offset (in 100 millisecond units). An awake time offset of 0 specifies immediate delivery, even if no awake time is specified.
0Eh*	1 byte	Delivery service type.  0=deliver immediately. 1=store until the node is awake. 2=store until the node is awake; automatically set awake time.
0Fh*	1 byte	Maximum stored message count. The maximum number of hello times that the parent node should store a message for the source child node.
10h	2 bytes	Decendent count.
11h	2 bytes	Device Identifier.
12h	4 bytes	Distributed Clock
13h	N*26 bytes	Port registration list
14h	1 byte	Unicast flooding level
15h	1 byte	Multicast flooding level
16h	N bytes	Network address
17h	N*2 bytes	Port ID list
18h	2 bytes	UHF MAC-D RFP threshold size
19h	2 bytes	UHF MAC-D maximum fragment size
1Ah	2 bytes	Direct Sequence channel ID
20H	2 bytes	Direct Sequence MAC-D maximum fragment size

\*Delivery service and awake time parameters (0C, 0D, 0E and 0F) are processed for all unicast messages.

## MAC-R Request Packet Formats.

### Data (Type 000).

MAC-D Header	
MAC-R Header	
MAC-R Sequence	2 bytes
Optional Parm - Max. stored message count. - Delivery service type. - Wake up time. - Wake up time offset.	N bytes
Length(802.3)/Protocol(DIX)	2 bytes
LLC Header (optional)	
LLC Data (optional)	

### Alert (Type 001).

MAC-D Header	
MAC-R Header	
Alert Flags	2 bytes
Alert ID	2 bytes
Node 802 address	6 bytes
Node ID	2 bytes
(reserved)	2 bytes
Optional Parm	N bytes

### Detach (Type 100).

MAC-D Header	
MAC-R Header	
Detach Flags	2 bytes
Detach ID	2 bytes
Node 802 address	6 bytes
Node ID	2 bytes
MAC-R Sequence	2 bytes
Optional Parm	N bytes



### Echo (Type 101).

MAC-D Header	
MAC-R Header	
flags	2 bytes
Echo ID	2 bytes
Echo source address	6 bytes
Port	1 byte
Path count	1 byte
Path index	1 byte
Response Index	1 byte
Path parms length	2 bytes
Path list	M bytes
Path list parms	N bytes
Optional parms	O bytes
Data	P bytes

### Echo path list entry.

802 address	6 bytes
Input port	1 byte
Output port	1 byte
Input port type	1 byte
Output port type	1 byte
Request RSSI	1 byte
Response RSSI	1 byte
Request delay	1 byte
Response delay	1 byte
Nr requests	2 bytes
Nr responses	2 bytes
Flags	1 byte (0x01=response required, 0x02=response from terminal)
Parm count	1 byte
Parm offset	2 bytes

### Hello (Type 010).

MAC-D Header	
MAC-R Header	
Optional Parms	N bytes

### Attach (Type 011).

MAC-D Header	
MAC-R Header	
Attach Flags	2 bytes
Attach ID	2 bytes
802 Address of Last Parent	6 bytes
Node ID	2 bytes
MAC-R Unicast Data Sequence	2 bytes
Optional Parms <ul style="list-style-type: none"> <li>- Max. stored message count.</li> <li>- Delivery service type.</li> <li>- Wake up time.</li> <li>- Wake up time offset.</li> </ul>	N bytes

### Attach Flags.

bit 15-11	(reserved)	must be zero
bit 10	Multicast flood flag	1 = if bit 8 is 1, then the secondary LAN requires multicast flooding
bit 9	Unicast flood flag	1 = if bit 8 is 1, then the secondary LAN requires unicast flooding
bit 8	Remote LAN flag	1 = the attaching AP is the designated bridge for a secondary LAN
bit 7	Child	1 = the attach is from a child
bit 6	AP flag	1 = the attaching node is an AP
bit 5	Update sequence flag	1 = sequence transferred from last AP parent
bit 4	Reset sequence flag	1 = reset sequence
bit 3	Remote flag	1 = the attach is for a remote (non-OWL) node
bit 2	ATTI	1 = attach indication
bit 1	Detach pending flag	1 = a detach request is pending for this attach
bit 0	Distributed flag	1 = the path to the source is through a distributed AP

### Registration (Type 110).

MAC-D Header	
MAC-R Header	
Network Node ID	2 bytes
(reserved)	4 bytes (must be 0)
REGISTRATION Operation	1 byte (must be 0)
Reason Code	1 byte
Flags	2 bytes
Alias type (07h)	1 byte
Alias length	1 byte
Alias	N bytes
Device ID type (11h)	1 byte
Device ID length	1 byte
Device ID	2 bytes
Network address type (16h)	1 byte
Network address length	1 byte
Network address	N bytes

The network node ID must be set to the multicast ID for the node type (i.e. BFFF or DFFF). The optional alias field can contain a 1 to 16-byte node name. The optional device ID field can contain a 2-byte device identifier. The optional network address field can contain a network address. The address server will set the network node ID field to the next available node ID, for the node type, in the response PDU. If a node ID is not available, the field will be set to all 1's. Note that the MAC-D source node ID is the multicast node ID for the node type (i.e. BFFF or DFFF) on OWL radio ports.

An AP can request a port ID per port by including a registration list as an optional parameter in the registration request PDU. The parm type is hex. 13. The format of a registration list entry is shown below:

### Registration list entry.

Ethernet address	6 bytes
Port ID	2 bytes (contains returned port ID)
Alias length	1 byte
Alias	16 bytes
Reason Code	1 byte

### Dist\_Attach (Type 111).

Ethernet MAC-D Header	
MAC-R Header	
Attach Flags	2 bytes
Attach ID	2 bytes
Optional Params	N bytes

## Bridge Response Packet Formats.

### R-Data (Type 000).

MAC-D Header	
MAC-R Header	
MAC-R Sequence	2 bytes
Optional Params - Max. stored message count. - Delivery service type. - Wake up time. - Wake up time offset.	N bytes
LLC Header (optional)	
LLC Data (optional)	

### Alert (Type 001).

MAC-D Header	
MAC-R Header	
Alert Flags	2 bytes
Alert ID	2 bytes
Node 802 address	6 bytes
Node ID	2 bytes
(reserved)	2 bytes
Optional Params	N bytes

### Detach (Type 100).

MAC-D Header	
MAC-R Header	
Detach Flags	2 bytes
Detach ID	2 bytes
Node 802 address	6 bytes
Node ID	2 bytes
MAC-R Sequence	2 bytes
Optional Params	N bytes

### Echo (Type 101).

MAC-D Header	
MAC-R Header	
flags	2 bytes
Echo ID	2 bytes
Echo source address	6 bytes
Port	1 byte
Path count	1 byte
Path index	1 byte
Response Index	1 byte
Path parms length	2 bytes
Path list	M bytes
Path list parms	N bytes
Optional parms	O bytes
Data	P bytes

### Hello (Type 010).

MAC-D Header	
MAC-R Header	
Network Node ID	2 bytes
Cost-to-root	2 bytes (0xFFFF = infinity)
Hello Seed	1 byte
Offset	1 byte  0-254 = transmission offset time in hundredths of seconds. 255 = unscheduled.
Root Priority	1 byte
Root Sequence Number	1 byte
Root 802 Address	6 bytes
Hello Period	1 byte (average hello period in tenths of seconds. e.g. 20 = 2 seconds)
Multi-count	1 byte (number of multicast messages which will follow this HELLO)
Flags	1 byte (must be 0)
Bridge Priority	1 byte
Load	1 byte
Optional parms (e.g.) - Pending Message List - Alert List - Distributed Clock	N bytes

### Attach (Type 011).

MAC-D Header	
MAC-R Header	
Attach Flags	2 bytes
Attach ID	2 bytes
802 Address of Last Parent	6 bytes
Node ID	2 bytes
MAC-R Sequence	2 bytes
Optional Params - Max. stored message count. - Delivery service type. - Wake up time. - Wake up time offset.	N bytes

### Registration (Type 110).

MAC-D Header	
MAC-R Header	
Network Node ID	2 bytes
(reserved)	4 bytes (must be 0)
REGISTRATION Operation	1 byte (must be 0)
Reason Code	1 byte
Flags	2 bytes
Alias type (07h)	1 byte
Alias length	1 byte
Alias	N bytes
Device ID type (11h)	1 byte
Device ID length	1 byte
Device ID	2 bytes